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## USE OF HYDROXYCARBOXYLATES FOR WATER HARDNESS CONTROL

### CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 61/097,398, filed on Sep. 16, 2008 and entitled "USE OF HYDROXYCARBOXYLATES FOR WATER HARDNESS CONTROL." The entire contents of this patent application are hereby expressly incorporated herein by reference including, without limitation, the specification, claims, and abstract, as well as any figures, tables, or drawings thereof.

### FIELD OF THE INVENTION

The present invention is related to compositions including a threshold agent, i.e., a hydroxycarboxylate, and methods of employing them. The methods and compositions provide a threshold agent at an amount sufficient to control water hardness, i.e., to substantially reduce or inhibit calcium precipitation, in the wash solutions in which they are present. The compositions can be used for cleaning and rinsing articles with reduced hard water spotting and scaling.

### BACKGROUND

The level of hardness in water can have a deleterious effect in many systems. For example, when hard water alone, or in conjunction with cleaning compositions, contacts a surface, it can cause precipitation of hard water scale on the contacted surface. In general, hard water refers to water having a total level of calcium and magnesium ions in excess of about 100 ppm expressed in units of ppm calcium carbonate. Often, the molar ratio of calcium to magnesium in hard water is about 2:1 or about 3:1. Although most locations have hard water, water hardness tends to vary from one location to another.

Hard water is also known to reduce the efficacy of detergents. One method for counteracting this includes adding chelating agents or sequestrants into detergent compositions that are intended to be mixed with hard water in an amount sufficient to handle the hardness. However, in many instances the water hardness exceeds the chelating capacity of the composition. As a result, free calcium ions may be available to attack active components of the composition, to cause precipitation, or to cause other deleterious effects, such as poor cleaning effectiveness or lime scale build up.

### SUMMARY

In some aspects, the present invention provides a method for cleaning an article. The method comprises providing a cleaning composition. The cleaning composition may comprise, consist essentially of, or consist of: (i) a hydroxycarboxylate compound, and/or a salt thereof; and (ii) a source of alkalinity. The cleaning composition is diluted with water to form a wash solution such that the hydroxycarboxylate compound is present in the wash solution at about 10 ppm to about 100 ppm. The article is then contacted with the wash solution, such that the article is cleaned.

In other aspects the present invention provides a cleaning composition comprising, consisting essentially of, or consisting of: (a) about 0.004 wt-% to about 0.008 wt-% of a hydroxycarboxylate; and (b) about 0 wt-% to about 50 wt-% source of alkalinity.

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In yet other aspects, the present invention provides methods for removing soil from a motor vehicle. The method may comprise, consist of, or consist essentially of providing a cleaning composition. The cleaning composition may comprise, consist of, or consist essentially of: (i) a hydroxycarboxylate compound, or salt thereof; and (ii) a source of alkalinity. The method also includes diluting the cleaning composition with water to form a wash solution such that the hydroxycarboxylate compound is present in the wash solution at about 10 ppm to about 100 ppm. The motor vehicle is then contacted with the wash solution such that the motor vehicle is cleaned.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a graphical depiction of the grams of calcium held in solution per 100 g of test solution used as described in Example 2.

FIG. 2 is a graphical depiction of the number of moles of calcium held in solution per 100 g of test solution used as described in Example 2.

FIG. 3 is a graphical depiction of the average soil removal for five cleaning formulations as described in Example 4.

FIG. 4 is a graphical depiction of the average soil removal for two cleaning formulations as described in Example 4.

FIG. 5A is a graphical depiction of the percent transmission over time at 85° F. for four different test solutions of the present invention as described in Example 7.

FIG. 5B is a graphical depiction of the percent transmission over time at 100° F. for four different test solutions of the present invention as described in Example 7.

FIG. 5C is a graphical depiction of the percent transmission over time at 120° F. for four different test solutions of the present invention as described in Example 7.

FIG. 5D is a graphical depiction of the percent transmission over time at 140° F. for four different test solutions of the present invention as described in Example 7.

### DETAILED DESCRIPTION

In some aspects, the present invention provides compositions and methods for cleaning an article. In some embodiments, a cleaning composition including a threshold agent, i.e., a hydroxycarboxylate compound, or salt thereof, and a source of alkalinity is provided. The composition is diluted with water to form a wash solution. In some embodiments, the composition is diluted such that the threshold agent, i.e., hydroxycarboxylate compound, is present in the wash solution at about 10 ppm to about 100 ppm. The article to be cleaned is then contacted with the wash solution, such that the article is cleaned.

So that the present invention may be more readily understood certain terms are first defined.

As used herein, the terms "chelating agent" and "sequestrant" refer to a compound that forms a complex (soluble or not) with water hardness ions (from the wash water, soil and substrates being washed) in a specific molar ratio. Chelating agents that can form a water soluble complex include trisodium phosphate, EDTA, DTPA, NTA, citrate, and the like. Sequestrants that can form an insoluble complex include sodium triphosphate, zeolite A, and the like. As used herein, the terms "chelating agent" and "sequestrant" are synonymous.

As used herein, the term "free of chelating agent" or "substantially free of chelating agent" refers to a composition, mixture, or ingredients that does not contain a chelating agent or sequestrant or to which only a limited amount of a chelat-